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MATHEMATICS

TARGET : JEE- Advanced 2021

CAPS-24

PARABOLA

ANSWER KEY OF CAPS-24

1.	(A)	**2.**	(B)	**3.**	(A)	**4.**	(B)	**5.**	(B)
6.	(B)	**7.**	(A)	**8.**	(AD)	**9.**	(BCD)	**10.**	(ABD)
11.	(ABC)	**12.**	(BCD)	**13.**	(ABCD)	**14.**	(C)	**15.**	(A)
16.	(D)	**17.**	(512)	**18.**	(α = 2)	**19.**	(0, 0), (8, 16) and (3, – 4)		
20.	(2)	**21.**	(5)	**22.**	(3)	**23.**	(A) S, (B) Q, (C) S, (D) P, (E) R		
24.	(A) P; (B) Q; (C) R								

SCQ (Single Correct Type) :

1. PQ is a chord of parabola $x^2 = 4y$ which subtends right angle at vertex. Then locus of centroid of triangle PSQ, where S is the focus of given parabola, is

(A) $x^2 = 4(y + 3)$ (B) $x^2 = \frac{4}{3}(y - 3)$ (C) $x^2 = \frac{-4}{3}(y + 3)$ (D) $x^2 = \frac{-4}{3}(y + 3)$

Ans. (B)

Sol. Let $P(2t_1, t_1^2)$; $Q(2t_2, t_2^2)$

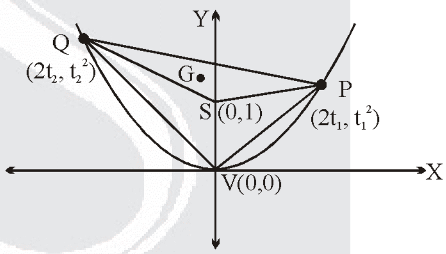
Clearly, $t_1t_2 = -4$ ....(1)

Also, $h = \frac{2t_1 + 2t_2}{3}$ ....(2)

$\Rightarrow \frac{3h}{2} = t_1 + t_2$

and $k = \frac{1 + t_1^2 + t_2^2}{3}$ ....(3)

$\Rightarrow 3k = 1 + t_1^2 + t_2^2$



$\therefore$ On eliminating we get t_1, t_2 from (1), (2) and (3) , $\frac{9h^2}{4} = 3k - 9$

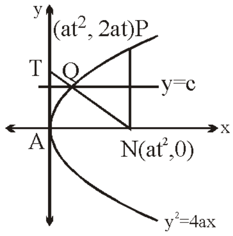
$\Rightarrow x^2 = \frac{4}{3}(y - 3)$

2. PN is an ordinate of the parabola $y^2 = 4ax$ (P on $y^2 = 4ax$ and N on x-axis). A straight line is drawn parallel to the axis to bisect NP and meets the curve in Q. NQ meets the tangent at the vertex A in apoint T such that AT = kNP, then the value of k is (where A is the vertex)

(A) 3/2 (B) 2/3 (C) 1 (D) 1/3

Ans. (B)

Sol. Equation of PN : $x = at^2$



$y = c$ bisects PN

$\therefore \quad c = at$

which cuts the parabola at Q

$\Rightarrow \quad c^2 = 4ax \qquad \therefore \qquad x = \dfrac{c^2}{4a}$

$\therefore \quad Q\left(\dfrac{c^2}{4a}, c\right) = Q\left(\dfrac{at^2}{4}, at\right)$

$\therefore$ Equation of NQ: $y - 0 = \dfrac{at - 0}{\dfrac{at^2}{4} - at^2}(x - at^2)$; $\quad y = \dfrac{-4}{3t}(x - at^2)$

which cuts $x = 0$ at $\left(0, \dfrac{4at}{3}\right)$

$\therefore \quad T = \dfrac{4at}{3}$ and $NP = 2at$; $\qquad \therefore \quad \dfrac{AT}{NP} = \dfrac{4at/3}{2at} = \dfrac{2}{3}$ **Ans.**

3. Locus of the feet of the perpendiculars drawn from vertex of the parabola $y^2 = 4ax$ upon all such chords of the parabola which subtend a right angle at the vertex is

(A) $x^2 + y^2 - 4ax = 0$ (B) $x^2 + y^2 - 2ax = 0$

(C) $x^2 + y^2 + 2ax = 0$ (D) $x^2 + y^2 + 4ax = 0$

Ans. **(A)**

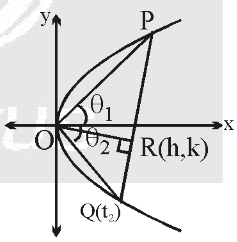
Sol. Chord with feet of the perpendicular as (h, k) is $hx + ky = h^2 + k^2$ .....(1)

homogenise $y^2 = 4ax$ with the help of (1) and use coefficient of x^2 + coefficient of $y^2 = 0$

$\tan\theta_1 = \dfrac{2}{t_1}$; $\tan\theta_2 = \dfrac{2}{t_2}$

$\dfrac{2}{t_1}\cdot\dfrac{2}{t_2} = -1, \qquad \therefore \qquad t_1t_2 = -4$

$\therefore$ equation of chord PQ $\quad 2x - (t_1 + t_2)y - 8a = 0$



slope of AR × slope of PQ = – 1

$\therefore \quad \dfrac{k}{h}\left(\dfrac{2}{t_1 + t_2}\right) = -1$

$\therefore \quad t_1 + t_2 = \dfrac{-2k}{h}$

$\therefore$ equation of chord PQ will be $2x - \left(\dfrac{-2k}{h}\right)y - 8a = 0$

$hx + ky = 4ah$

(h, k) lies on this line

$\therefore \quad h^2 + k^2 = 4ah$

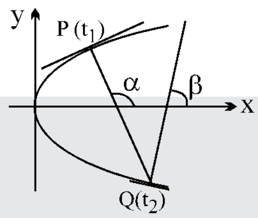
$\therefore$ locus of R(h, k) is $x^2 + y^2 = 4ax$ **Ans.**

4. If the normal to a parabola $y^2 = 4ax$ at P meets the curve again in Q and if PQ and the normal at Q makes angles α and β respectively with the x-axis then $\tan\alpha(\tan\alpha + \tan\beta)$ has the value equal to

(A) 0 (B) – 2 (C) $-\frac{1}{2}$ (D) – 1

Ans. **(B)**

Sol. $\tan\alpha = -t_1$ and $\tan\beta = -t_2$



also $t_2 = -t_1 - \frac{2}{t_1}$

$t_1 t_2 + t_1^2 = -2$

$\tan\alpha \tan\beta + \tan^2\alpha = -2 \Rightarrow$ (B)

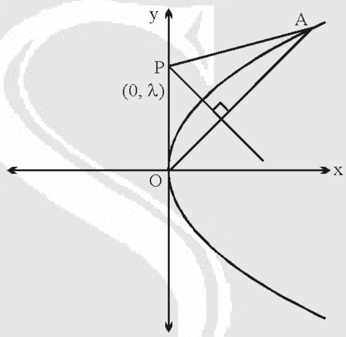
5. From a variable point P on the tangent at the vertex of a parabola $y^2 = 2x$, a line is drawn perpendicular at chord of contact. These variable lines always passes through a fixed point, where co-ordinates are

(A) $\left(\frac{1}{2}, 0\right)$ (B) (1, 0) (C) $\left(\frac{3}{2}, 0\right)$ (D) (2, 0)

Ans. **(B)**

Sol. $y^2 = 4ax$; $a = \frac{1}{2}$

equation of the chord of contact of P $(0, \lambda)$



$\lambda y = 2ax$

$2ax - \lambda y = 0$ ....(1)

Line perpendicular to it

$\lambda x + 2ay = c$, it passes through $(0, \lambda)$

$0 + 2a\lambda = c$

$\therefore \lambda x + 2ay + 2ay = 0$

$\lambda(x - 2a) + 2ay = 0$

$(x - 2a) + \left(\frac{2a}{\lambda}\right) y = 0$

Passes through (2a, 0) i.e. (1, 0) **Ans.**

6. If two normals to a parabola $y^2 = 4ax$ intersect at right angles then the chord joining their feet passes through a fixed point whose co-ordinates are :

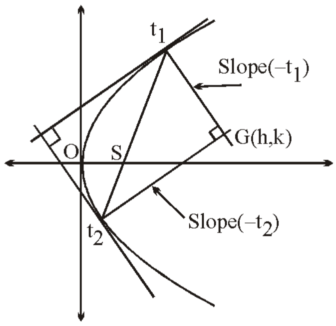
(A) (–2a, 0) (B) (a, 0) (C) (2a, 0) (D) none

Ans. **(B)**

Sol. N : $y + tx = 2at + at^3$; passes through (h, k)

Hence $at^3 + (2a - h)t + k = 0$

$$t_1 t_2 t_3 = -\frac{k}{a} \; ; \; t_1 t_2 = -1$$



chord joining t_1 and t_2 is

$$2x - (t_1 + t_2)y + 2at_1 t_2 = 0$$

$$(2x - 2a) - (t_1 + t_2)y = 0 \Rightarrow x = a \;\&\; y = 0$$

Alternatively: If the normal intersect at right angles then their corresponding tangents will also intersect at right angles hence the chord joining their feet must be a focal chord

$\therefore$ it will always pass through (a, 0)

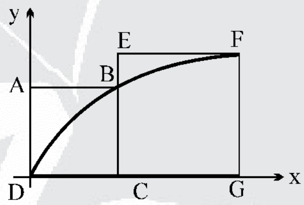
7. ABCD and EFGC are squares and the curve $y = k\sqrt{x}$ passes through the origin D and the points B and F. The ratio $\frac{FG}{BC}$ is

(A) $\frac{\sqrt{5}+1}{2}$

(B) $\frac{\sqrt{3}+1}{2}$

(C) $\frac{\sqrt{5}+1}{4}$

(D) $\frac{\sqrt{3}+1}{4}$



Ans. **(A)**

Sol. $y^2 = k^2 x \quad \Rightarrow \quad y^2 = 4ax$ where $k^2 = 4a$

$B = \left(at_1^2, 2at_1\right)$; $F = \left(at_2^2, 2at_2\right)$ $\quad \{t_1 > 0, t_2 > 0\}$

to find $\frac{FG}{BC} = \frac{2at_2}{2at_1} = \frac{t_2}{t_1}$

now $\quad DC = BC \quad \Rightarrow \quad at_1^2 = 2at_1 \quad \Rightarrow \quad t_1 = 2$

also $\quad at_2^2 - at_1^2 = 2at_2$

$$t_2^2 - 4 = 2t_2$$

$$t_2^2 - 2t_2 - 4 = 0$$

$$t_2 = \frac{2 \pm \sqrt{4+16}}{2} \text{ but } t_2 > 0 \quad \therefore \quad t_2 \neq \frac{2-\sqrt{20}}{2}$$

$$t_2 = \left(\sqrt{5}+1\right)$$

$\therefore \quad \frac{t_2}{t_1} = \frac{\sqrt{5}+1}{2}$ Ans.

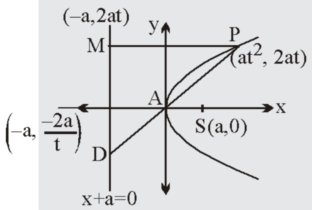
MCQ (One or more than one correct) :

8. P is a point on the parabola $y^2 = 4ax$ $(a > 0)$ whose vertex is A. PA is produced to meet the directrix in D and M is the foot of the perpendicular from P on the directrix. If a circle is described on MD as a diameter then it intersects the x–axis at a point whose co–ordinates are :

(A) $(-3a, 0)$ (B) $(-a, 0)$ (C) $(-2a, 0)$ (D) $(a, 0)$

Ans. **(AD)**

Sol. Circle : $(x + a)^2 + (y - 2at)\left(y + \frac{2a}{t}\right) = 0$



from y = 0, $x^2 + 2ax - 3a^2 = 0 \Rightarrow x = a$ or $-3a$

9. The focus of the parabola is (1, 1) and the tangent at the vertex has the equation $x + y = 1$. Then

(A) equation of the parabola is $(x - y)^2 = 2(x + y - 1)$

(B) equation of the parabola is $(x - y)^2 = 4(x + y - 1)$

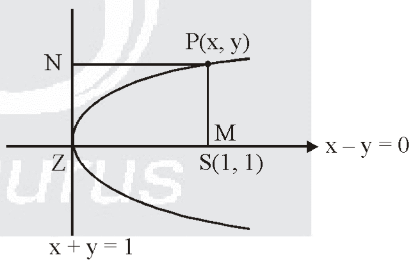
(C) the co-ordinates of the vertex are $\left(\frac{1}{2}, \frac{1}{2}\right)$

(D) length of the latus rectum is $2\sqrt{2}$

Ans. **(BCD)**

Sol. $a = ZS = \frac{1}{\sqrt{2}}$

Equation of parabola is $PM^2 = 4 \cdot a \cdot PN$



$$\left(\frac{x-y}{\sqrt{2}}\right)^2 = 4 \cdot \frac{1}{\sqrt{2}} \cdot \left(\frac{x+y-1}{\sqrt{2}}\right)$$

$\therefore$ $(x - y)^2 = 4(x + y - 1)$

Length of latus rectum $= 4a = 4 \times \frac{1}{\sqrt{2}} = 2\sqrt{2}$

Solve $x - y = 0$ & $x + y = 1$, we get coordinate to vertex i.e. $\left(\frac{1}{2}, \frac{1}{2}\right)$.

10. Consider the parabola whose equation is $y = x^2 - 4x$ and the line $y = 2x - b$. Then which of the following is/are correct?

(A) For b = 9 the line is a tangent to the parabola.

(B) For b = 7 the line cuts the parabola in A and B such that the $\angle AOB$ is a right angle when 'O' is the origin.

(C) For some $b \in R$ the line cuts the parabola in C and D such that x-axis bisects the $\angle COD$.

(D) For b > 9 the line passes outside the parabola.

Ans. **(ABD)**

Sol. (A) For b = 9 solving line and parabola

$2x - 9 = x^2 - 4x \quad \Rightarrow \quad x^2 - 6x + 9 = 0 \quad \Rightarrow \quad (x - 3)^2 = 0$

$\therefore$ line is tangent to parabola $\Rightarrow$ **(A)** is correct

(B) For b = 7, line is $y = 2x - 7$

Homogenising parabola with line

$$x^2 - 4x\left(\frac{2x - y}{7}\right) - y\left(\frac{2x - y}{7}\right) = 0$$

coefficient of x^2 + coefficient of $y^2 = 0 \Rightarrow 1 - \frac{8}{7} + \frac{1}{7} = 0$

$\therefore$ $\angle AOB$ is 90° $\Rightarrow$ **(B)** is correct

(C) Homogenising the parabola with line, we get

$$x^2 - 4x\left(\frac{2x - y}{b}\right) - y\left(\frac{2x - y}{b}\right) = 0$$

for x-axis to bisect $\angle COD$

coefficient of xy should be zero

i.e. $\frac{4}{b} - \frac{2}{b} = 0$

which is not possible for any $b \in R$. $\Rightarrow$ **(C)** is false

(D) For b > 9

Solving line and parabola

$x^2 - 6x + b = 0$

$D = 36 - 4b$

If $b > 9$

then $D < 0$

$\therefore$ line passes outside the parabola $\Rightarrow$ **(D)** is correct.

11. The straight line y + x = 1 touches the parabola

(A) $x^2 + 4y = 0$ (B) $x^2 - x + y = 0$ (C) $4x^2 - 3x + y = 0$ (D) $x^2 - 2x + 2y = 0$

Ans. **(ABC)**

Sol. put $y = 1 - x$ and see that the resulting exprassion is a perfect square

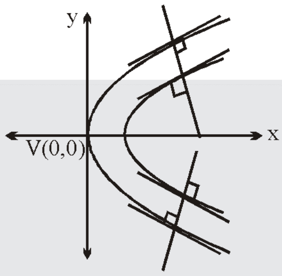
12. If the two parabolas $y^2 = 4x$ and $y^2 = (x - k)$ have a common normal other than the x-axis then k can be equal to

(A) 1 (B) 2 (C) 3 (D) 4

Ans. **(BCD)**

Sol. Normal to $y^2 = 4x$ is

$y = mx - 2m - m^3$ ......(1) (a = 1)



normal to $y^2 = (x - k)$

$y = m(x - k) - \frac{2}{4}m - \frac{1}{4}m^3$

$\Rightarrow$ $y = mx - km - \frac{m}{2} - \frac{m^3}{4}$ ....(2)

$\therefore$ From (1) and (2)

$2m + m^3 = km + \frac{m}{2} + \frac{m^3}{4}$ $\Rightarrow$ $2 + m^2 = k + \frac{1}{2} + \frac{m^2}{4}$ $(m \neq 0)$

$\Rightarrow \frac{3m^2}{4} = \left(k - \frac{3}{2}\right) > 0 \Rightarrow k > \frac{3}{2}$

$\Rightarrow$ k = 2, 3, 4 $\Rightarrow$ B, C, D **Ans.**

13. PQ is a double ordinate of the parabola $y^2 = 4ax$. If the normal at P intersect the line passing through Q and parallel to axis of x at G, then locus of G is a parabola with

(A) length of latus rectum equal to 4a. (B) vertex at (4a, 0).

(C) directrix as the line $x - 3a = 0$ (D) focus as (5a, 0)

Ans. **(ABCD)**

Sol. N : $y + tx = 2at + at^3$

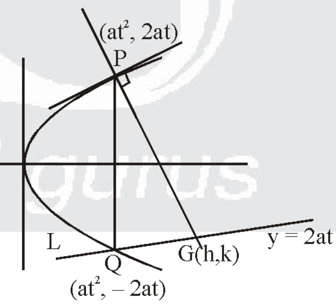
L : $y = -2at$

solving together

$-2at + tx = 2at + at^3$

$x = at^2 + 4a$

hence, $h = at^2 + 4a$ and $k = -2at$



$\frac{k^2}{4a^2} = \frac{h - 4a}{a}$ $\Rightarrow$ $y^2 = 4a(x - 4a)$.

Now verify all the alternatives. **Ans.**

Comprehension Type Question:

Comprehension

A variable circle passes through the point A (2, 1) and touches the x-axis. Locus of the other end of the diameter through A is a parabola.

14. Find the length of the latus rectum of the parabola.

(A) 2 (B) 3 (C) 4 (D) 5

Ans. **(C)**

15. Find the coordinates of the foot of the directrix of the parabola.

(A) (2, – 1) (B) (1, – 2) (C) (–2, 1) (D) (–2, – 1)

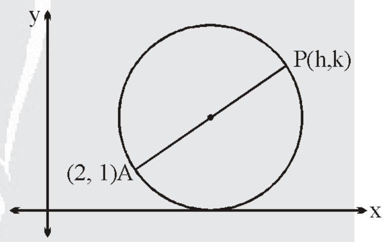
Ans. **(A)**

16. The two tangents and two normals at the extremities of the latus rectum of the parabola constitutes a quadrilateral. Find area of quadrilateral.

(A) 3 sq. unit (B) 4 sq. units (C) 6 sq. units (D) 8 sq. units

Ans. **(D)**

Sol. **(i)** Equation of the variable circles



$(x - h)(x - 2) + (y - k)(y - 1) = 0$

$x^2 + y^2 - (2 + h)x - (k + 1)y + k + 2h = 0$

As x-intercept = 0

$\Rightarrow g^2 = c$

$\therefore \frac{(h+2)^2}{4} = k + 2h$

$\Rightarrow (h + 2)^2 = 4k + 8h$

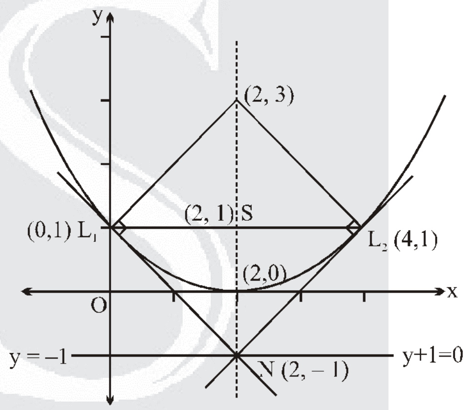
$\Rightarrow (h - 2)^2 = 4k$

$\therefore$ Locus is $(x - 2)^2 = 4y \Rightarrow$ L.R. = 4 **Ans.**

(ii) $N \equiv (2, -1)$ **Ans.**

(iii) Figure is a square.

$\therefore$ Area = $\frac{(4)(4)}{2}$ = 8 sq. units **Ans.**



Numerical based Questions :

17. Let P (a, b) and Q (c, d) are the two points on the parabola $y^2 = 8x$ such that the normals at them meet in (18, 12). Find the product (abcd).

Ans. **512**

Sol. $y^2 = 8x$

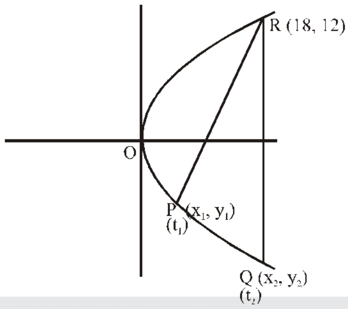
Let P(t_1^2, 4t) & a(t_2^2, $4t_1$)

& Normal at P & Q intersect R(18, 12)

Let R(18, 12) = ($2t_3^2$, $4t_3$)

$\Rightarrow \quad t_3 = 3$

$\therefore \quad t_3 = -t - \frac{2}{t}$ [Point of again intersection by normal to the parabola]



3 = –t –

$t^2 + 3t + 2 = 0$

$\Rightarrow t_1 = -1 \;;\; t_2 = -2$

Hence P(2, –4) & Q(8, –8)

$\therefore \quad a = 2;\; b = -4;\; c = 8;\; d = 8$

abcd = 512 **Ans.**

18. Normals are drawn from the point P with slopes m_1, m_2, m_3 to the parabola $y^2 = 4x$. If locus of P with $m_1m_2 = \alpha$ is a part of the parabola itself, then find α.

Ans. α **= 2**

Sol. $y^2 = 4x$ ……(1)

$y = mx - x^3 - 2m$

Let P(h, k) is on this normal

$\Rightarrow \; k = mh - m^3 - 2m$

$\Rightarrow \; m^3 + m(2 - h) + k = 0 \; \rightarrow m_1, m_2, m_3$ ……(2)

If three normals at (h, k)

$m_1 + m_2 + m_3 = 0$

$m_1 \, m_2 \, m_3 = -k$

& $\quad m_1m_2 = \alpha \;\Rightarrow\; m_3 = \frac{-k}{\alpha}$

$m_3 = \frac{-k}{\alpha}$ is a root of the eq. (2),

$\therefore \quad \frac{-k^3}{\alpha^3} - \frac{k}{\alpha}(2 - h) + k = 0$

$\Rightarrow \quad k = 0; \; \frac{-k^2}{\alpha^3} - \frac{(2-h)}{\alpha} + 1 = 0$

$\Rightarrow \quad \frac{k^2}{\alpha} = \frac{h + 2 - \alpha}{\alpha}$

$\Rightarrow \quad k^2 = \alpha^2 (h + 2 - \alpha)$ ……(4)

Eq. (1) & (4) are identical

$\therefore \quad \alpha = 2$

19. Three nromals are drawn from the point (14, 7) to the curve $y^2 - 16x - 8y = 0$. Find the coordinates of the feet of the normals.

Ans. **(0, 0), (8, 16) and (3, – 4)**

Sol. Given parabola is $y^2 - 16x - 8y = 0$ ....(1)

Let the coordinates of the feet of the normal from (14, 7) be $P(\alpha, \beta)$.

Now equation of the tangent at $P(\alpha, \beta)$ to parabola (1) is

$$y\beta - 8(x + \alpha) - 4(y + \beta) = 0$$

or $(\beta - 4)\, y = 8x + 8\alpha + 4\beta$ ....(2)

Its slope = $\frac{8}{\beta - 4}$

Equation of normal to parabola (1) at (α, β) is $y - \beta = \frac{4 - \beta}{8}(x - \alpha)$

It passes through (14, 7)

$\therefore$ $7 - \beta = \frac{6\beta}{\beta - 4}(14 - \alpha)$ or $\alpha = \frac{6\beta}{\beta - 4}$ .....(3)

Also (α, β) lies on parabola (1)

$\therefore$ $\beta^2 - 16\alpha - 8\beta = 0$ ......(4)

Putting the value of α from (3) in (4), we get

$$\beta^2 - \frac{96\beta}{\beta - 4} - 8\beta = 0$$

or $\beta^2(\beta - 4) - 96\beta - 8\beta(\beta - 4) = 0$

or $\beta(\beta^2 - 4\beta - 96 - 8\beta + 32) = 0$

or $\beta(\beta^2 - 12\beta - 64) = 0$

$\therefore$ $\beta = 0, 16, -4$

From (3), when $\beta = 0$, $\alpha = 0$

when $\beta = 16$, $\alpha = 8$

when $\beta = -4$, $\alpha = 3$

Hence the feet of the normals are (0, 0), (8, 16) and (3, – 4).

20. The normal chord at a point t on the parabola 2 y = 4ax subtends a right angle at its vertex. Find the value of 2 t .

Ans. **(2)**

Sol. $\frac{2}{t} \times \frac{2}{-\left(t + \frac{2}{t}\right)} = -1 \quad \Rightarrow 4 = t\left(t + \frac{2}{t}\right) \quad \Rightarrow t^2 = 2$

21. From the origin, tangents OA and OB are drawn to the curve $(x-2)^2+(y-2)^2=1$. If the line PQ, where P and Q are respectively the midpoints of OA and OB, touches the curve $(y+3)^2=4\alpha(x+4)$ and the length of latus rectum of the parabola is ℓ, then $\frac{\ell}{7}$ is _____.

Ans. **(5)**

Sol. Equation of PQ is $x+y=\frac{7}{4}$

Equation of tangent to the parabola is

$(y+3)=-(x+4)+\frac{a}{(-1)}$

$\Rightarrow\ x+y=-7-a$

$\Rightarrow\ -7-a=\frac{7}{4}\Rightarrow a=\frac{-35}{4}$

$\therefore$ LLR = $|4a|=35=\ell$

Thus, $\frac{\ell}{7}=5$

22. If two distinct chords of a parabola y^2 = 4ax passing through (a,2a) are bisected by the line x + y =1, and 4a is a natural number, then the maximum length of the latus–rectum is _____.

Ans. **(3)**

Sol. Any point on the line x+y=1 can be taken $(t,1-t)$

Equation of the chord, with this as mid point is $y(1-t)-2a(x+t)=(1-t)^2-4at$,

It passes through $(a,2a)$

So, $t^2-2t+2a^2-2a+1=0$, this should have 2 distinct real roots

so $a^2-a<0, 0<a<1$, so length of latusrectum < 4

Matrix Match Type :

23. Identify the conic whose equations are given in column-I.

	Column-I (Equation of a conic)		**Column-II (Nature of conic)**
(A)	$xy + a^2 = a(x + y)$	(P)	Ellipse
(B)	$2x^2 - 72xy + 23y^2 - 4x - 28y - 48 = 0$	(Q)	Hyperbola
(C)	$6x^2 - 5xy - 6y^2 + 14x + 5y + 4 = 0$	(R)	Parabola.
(D)	$14x^2 - 4xy + 11y^2 - 44x - 58y + 71 = 0$	(S)	line pair
(E)	$4x^2 - 4xy + y^2 - 12x + 6y + 8 = 0$		

Ans. **(A) S, (B) Q, (C) S, (D) P, (E) R**

Sol. (A) $\Delta = abc + 2fgh - af^2 - bg^2 - ch^2 = 0$

(B) $\Delta \neq 0$ and $h^2 > ab$.

(C) $\Delta = 0$

(D) $\Delta \neq 0$ and $h^2 < ab$

(E) $\Delta \neq 0$ and $h^2 = ab$.

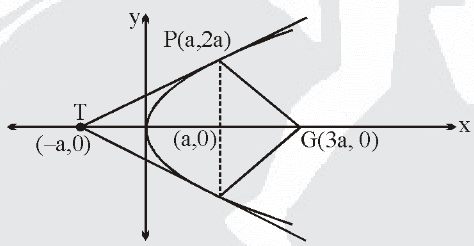
24. Consider the parabola $y^2 = 12x$

	Column-I	**Column-II**
(A)	Tangent and normal at the extremities of the latus rectum intersect the x axis at T and G respectively. The coordinates of the middle point of T and G are	(P) (3, 0)
(B)	Variable chords of the parabola passing through a fixed point K on the axis, such that sum of the squares of the reciprocals of the two parts of the chords through K, is a constant. The coordinate of the point K are	(Q) (6, 0)
		(R) (12, 0)
(C)	All variable chords of the parabola subtending a right angle at the origin are concurrent at the point	

Ans. **(A) P; (B) Q; (C) R**

Sol. For $y^2 = 4ax$, same standard property are given in our teaching notes.

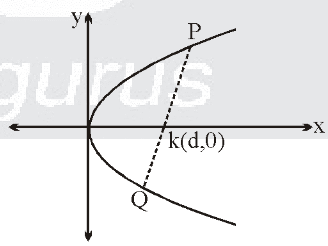
(A) Slope of PT = 1, slope of PG = – 1.



$\therefore$ mid point of T and G = (a, 0) = (3, 0)

a = 3 in this problem.

(B) We know that



$$\frac{1}{PK^2} + \frac{1}{QK^2} = \frac{1}{d^2} = \frac{1}{4a^2}$$

$\Rightarrow$ d = 2a

$\because$ a = 3 $\Rightarrow$ d = 6. **Ans.**

(C) Chord passes through (4a, 0) from the axis subtend 90° the vertex

$\therefore$ in this problem it is (12, 0).

$\therefore$ Correct A $\rightarrow$ (3, 0) = P
B $\rightarrow$ (6, 0) = Q
C $\rightarrow$ (12, 0) = R